Fabrication and Characterization of Carbonized Polyacrylonitrile Nanofibers for Composite Aircraft and Wind Turbine Manufacturing

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This study reports the fabrication, and characterization of carbonized polyacrylonitrile (PAN) nanofibers for improved surface conductivity of the composites. The PAN nanofibers produced through electrospinning process were stabilized in air at 270^{o}C for one hour and then carbonized at 850^{o}C in inert atmosphere (argon) for another hour. The carbonized nanofibers were placed on the surface of carbon fiber pre-preg composites as a top layer prior to the vacuum oven curing process. Surface morphology and microstructural analysis of the specimen were investigated using field emission scanning electron microscope (FESEM) after sputter coating with 10 nm of gold. Energy dispersive X-ray spectroscopy (EDX) was also carried out to determine the surface elemental distribution of the carbonized PAN nanofibers. The EDX results manifested the abundance of carbon content on the nanofiber surface along with small quantities of impurities. Thermomechanical analysis (TMA) exhibited the glass transition region in pre-preg nanocomposites and the significant dependence of coefficient of thermal expansion in the fiber directions. The dimensional changes in carbon fibers were observed due to the various temperature changes during the processing. This study provides the preliminary results of the carbonized nanofibers for future composite aircraft and wind turbine applications.